

Chapter 48 Nuclear Structure (Examples) (SM13)

Example 1: What is the ratio of the density of a proton to the density of a U 238 nucleus?

Example 2: What is the acceleration due to gravity at the surface of a neutron star if its radius is 10 km?

Example 3: Calculate the binding energy per nucleon for He 4.

H 1 mass = 1.007825 u n mass = 1.008665 u

He 4 mass = 4.002603 u 931.50 MeV/u

Example 4: The half-life of I 131 is 8.04 days. Calculate the decay constant. If a sample has an activity of 0.5 mCi, how many atoms are present?

Example 5: Tritium has a half-life of 12.33 years. What percentage of a sample will decay in the first year?

Example 6: If the activity of a sample decreases from 5 mCi to 3 mCi in 6 hours what is its half-life?

Example 7: A 0.001 gram sample of U 238 emits 738 α particles per minute. Over a human lifetime there is no detectable change in the activity of the sample. What is the half-life of U 238?

Example 8: Calculate Q for U 236 decaying to Th 232.

Example 9: When Ra 226 undergoes an alpha decay what is the kinetic energy of the out going alpha particle?

Example 10: What is the maximum kinetic energy of the beta particle when P 32 decays to S 32? Is this a beta - or a beta + decay?

Example 11: What is the maximum kinetic energy of the beta particle when N 13 decays to C 13?

Example 12: Why can't a free proton decay into a neutron? Why can the same reaction occur when the proton is part of a nucleus?

Example 13: How many decays per second would you expect from 30,000 year old sample that has a mass of 2.5 grams? (note that the ratio of C 14 to C 12 is 1.3×10^{-12} in living matter)